REMARKS

The Examiner is thanked for the thorough examination of this application. The Office Action, however, tentatively rejected all pending claims 1-13. Specifically, the Office Action rejected all claims under 35 U.S.C. § 103(a) as allegedly obvious over the combination of U.S. published application 2004/0038139 to Mui in view of U.S. patent 6,475,684 to Ki. For at least the reasons set forth herein, Applicant respectfully requests reconsideration and withdrawal of these rejections. Claims 1, 3, and 9 are independent claims, and Applicant's remarks will focus on these claims.

Applicant notes with appreciation the Examiner's review of the specification and claims and the Examiner's notation of several typographical or grammatical inconsistencies. Applicant has amended the specification and certain claims to address and correct these inconsistencies.

Response to rejections of claims 1 and 2

Claim 1 defines a method of creating a pattern in a layer of opaque material of a photolithographic exposure mask. Specifically, claim 1 recites:

> 1. A method of creating a pattern in a layer of opaque material of a photolithographic exposure mask, comprising:
> defining an etch recipe for etching a product pattern A in an opaque material over a substrate of a photolithographic exposure mask that optimally meets Critical Diameter (CD) requirements of the product pattern, said etching a product pattern comprising a photoresist exposure mask;
> calculating the product pattern total Cr etch loading on the exposure mask;
> defining a residual or useless surface area of the exposure mask;
> if the defined, optimum etch recipe meets the optimal Critical Diameter (CD) requirements, the exposure of the opaque material of the exposure mask is performed;
> if the defined, optimum etch recipe does not meet the optimal Critical Diameter (CD) requirements, ***then the Cr etch loading is modified by adding dummy patterns in unused areas of the photoresist exposure mask;***

> ***if the addition of dummy pattern to the product pattern does not meet the Cr etch loading, then the Cr loading pattern A is separated into two parts B and C, such that pattern B meets Cr loading requirements, after which pattern B is applied to a first exposure process and pattern C is applied for a second exposure process.***

(*Emphasis added.*) Claim 1 patently defines over the cited art of record because the cited art fails to disclose at least the features emphasized above.

An etch recipe is defined for etching a product pattern A in an opaque material over a substrate of a photolithographic exposure mask that optimally meets Critical Diameter (CD) requirements of the product pattern. The product pattern total Cr etch loading on the exposure mask is calculated. A residual or useless surface area of the exposure mask is defined. If the defined optimum etch recipe meets the optimal Critical Diameter (CD) requirements, the exposure of the opaque material of the exposure mask is performed. If the defined optimum etch recipe does not meet the optimal Critical Diameter (CD) requirements, then the Cr etch loading is modified by adding dummy patterns in unused areas of the photoresist exposure mask. If the addition of dummy pattern to the product pattern does not meet the Cr etch loading, then the Cr loading pattern A is separated into two parts B and C, such that pattern B meets Cr loading requirements. The pattern B is then applied to a first exposure process and pattern C is then applied for a second exposure process.

In contrast to the invention defined by claim 1, Mui et al. teach a method and apparatus for processing a semiconductor wafer providing for reducing CD microloading variation. Mui does not teach or suggest the method and system defined in claim 1. In this regard, Mui does not teach or fairly suggest the step of adding dummy patterns in unused areas of the photoresist exposure mask, as specifically recited in claim 1. Ki does not supply this missing teaching.

In this regard, Ki teaches a method of correcting for variation in line width due to loading effect generated when the material layer on a photomask substrate is dry-etched to have a desired pattern. Ki does not teach or fairly suggest the step of adding dummy patterns in unused areas of the photoresist exposure mask.

For at least the reasons described above, claim 1 patently defines over the combination of Mui and Ki (even assuming the teachings of these references are properly combined). As claim 2 depends from claim 1, it patently defines over the cited art for at least the same reason.

Response to rejections of claims 3-8

Claim 3 defines a method for creating a pattern of opaque material over the substrate of a photolithographic exposure mask. Specifically, claim 3 recites:

> 3. A method for the creation of a pattern of opaque material over the substrate of a photolithographic exposure mask, comprising:
> providing a CD performance criteria;
> accessing a product pattern to be created in an opaque layer of an exposure mask;
> determining a surface area of the product pattern;
> determining, based in the accessed product pattern, a Cr loading factor over the substrate of the photolithographic exposure mask;
> accessing an etch recipe of the opaque layer of an exposure mask, the etch recipe meeting Critical Diameter (CD) performance criteria for the determined Cr loading factor, this etch recipe being valid for the calculated Cr loading factor or for a Cr loading factor that is within determined limits of the Cr loading factor;
> if CD performance criteria is met by the accessed etch recipe, the etch of the opaque layer is performed;
> ***if the CD performance criteria is not met by the accessed etch recipe, dummy patterns are added in a dummy area of the mask;***
> ***re-calculating the Cr loading factor, comprising the product pattern and the created dummy pattern;***
> accessing a new etch recipe of the opaque material, the new etch recipe meeting the CD performance criteria for the re-calculated Cr load factor;
> etching, if CD performance criteria is met by the newly accessed etch recipe, the opaque material; and

> ***returning, if CD performance criteria is not met by the newly accessed etch recipe, to the preceding step of determining, based in the accessed product pattern, a Cr loading factor over the substrate of the photolithographic exposure mask.***

(*Emphasis added.*) Claim 3 patently defines over the cited art of record because the cited art fails to disclose at least the features emphasized above.

Generally, as recited in claim 3, a CD performance criteria is provided. A product pattern to be created in an opaque layer of an exposure mask is accessed. A surface area of the product pattern is determined. A Cr loading factor over the substrate of the photolithographic exposure mask is determined according to the accessed product pattern. An etch recipe of the opaque layer of an exposure mask is accessed. If the etch recipe meets Critical Diameter (CD) performance criteria for the determined Cr loading factor, this etch recipe is regarded as valid for the calculated Cr loading factor or for a Cr loading factor that is within determined limits of the Cr loading factor. If CD performance criteria is met by the accessed etch recipe, the etch of the opaque layer is performed. If the CD performance criterion is not met by the accessed etch recipe, dummy patterns are added in a dummy area of the mask. The Cr loading factor is re-calculated, comprising the product pattern and the created dummy pattern. A new etch recipe of the opaque material is accessed, the new etch recipe meets the CD performance criteria for the re-calculated Cr load factor. If the CD performance criterion is met by the newly accessed etch recipe, the opaque material is etched. If CD performance criteria is not met by the newly accessed etch recipe, the method is returned to the preceding step of determining, based in the accessed product pattern, a Cr loading factor over the substrate of the photolithographic exposure mask.

In contrast, Mui et al. teach a method and apparatus for processing a semiconductor wafer providing for reducing CD microloading variation. Mui does not teach or suggest the method and system disclosed in the present invention. Mui does not teach or fairly suggest the steps of adding dummy patterns in a dummy area of the mask, if the CD performance criterion is not met, and then re-calculating the Cr loading factor (which comprises the product pattern and the created dummy pattern). Ki does not supply this missing teaching either.

Instead, Ki teaches a method of correcting for variation in line width due to loading effect generated when the material layer on a photomask substrate is dry-etched to have a desired pattern. Ki does not teach or fairly suggest the step of adding dummy patterns in dummy areas (e.g., unused areas) of the photoresist exposure mask.

Thus, even if combined, Mui and Ki do not render claim 3 obvious, and the rejection of claim 3 should be withdrawn. The rejections of dependent claims 4-8 should be withdrawn for at least the same reasons.

Response to rejections of claims 9-13

Claim 9 defines a method for the creation of a pattern of opaque material over the substrate of a photolithographic exposure mask. Specifically, claim 9 recites:

> 9. A method for the creation of a pattern of opaque material over the substrate of a photolithographic exposure mask, comprising:
> determining several dry-etch recipes, whereby these several dry-etch recipes provide optimum CD performance for a number of different fixed pattern loading recipes such as 20%, 50% and 80%, said fixed pattern loading comprising forbidden surface areas;
> calculating total Cr etch loading for a given product;
> deriving, from the calculated total Cr etch loading a residue and useless area on the photolithographic mask;
> determining a pattern of Cr etching by calculating a loading factor X, whereby X=(Cr etching area/total mask area)*100%, whereby 0%<X<100%;

performing, for values of X=20% and 50% and 80%, a first exposure;

if for standard Cr etch recipes of respectively A=20%, B=50% or C=80%, if respectively values of X<20% or <50% or <80%, determine if enough dummy pattern can be provided to meet the criteria of X+Y=20% or 50% or 80%;

if the latter criteria can be met with the dummy pattern the second exposure is performed; and

separating, if the latter criteria cannot be met, the original patterns into pattern B and pattern C.

(*Emphasis added.*) Claim 9 patently defines over the cited art for at least the reason that the cited art fails to disclose the features emphasized above.

As defined in claim 9, several dry-etch recipes are determined, whereby these several dry-etch recipes provide optimum CD performance for a number of different fixed pattern loading recipes such as 20%, 50% and 80%, said fixed pattern loading comprising forbidden surface areas. Total Cr etch loading for a given product is calculated. A residue and useless area is determined on the photolithographic mask according to the calculated total Cr etch loading. A pattern of Cr etching is determined by calculating a loading factor X, whereby X=(Cr etching area/total mask area)*100%, whereby 0%<X<100%. A first exposure is performed, for values of X=20% and 50% and 80%. If for standard Cr etch recipes of respectively A=20%, B=50% or C=80%, if respectively values of X<20% or <50% or <80%, it is determined if enough dummy pattern can be provided to meet the criteria of X+Y=20% or 50% or 80%. If the latter criteria can be met with the dummy pattern, the second exposure is performed. If the latter criteria cannot be met, the original patterns are separated into pattern B and pattern C.

Simply stated, neither Mui nor Ki teach or suggest these features. In this regard, Applicant particularly notes the claim elements directed to the dummy patterns. No such comparable teaching is found in the cited art. Furthermore, the undersigned respectfully submits that the Office Action has failed to set forth an adequate rejection of claim 9. In this regard,

claim 9 defines and recites specific percentages and values in the various method steps. Nowhere, however, in the Office Action is there even an allegation that such numerical values or percentages are disclosed in the cited art.

Furthermore, Applicant has had difficulty in fully understanding the rejections of the Office Action. In this regard, the Office Action provides a 2-3 page narrative discussion of the cited art, but has not made indications of what teachings purportedly apply to the specific claims. Instead, the narrative discussion appears to apply generally to all claims 1-13. Should the Patent Office continue to reject these claims, the undersigned respectfully requests that any ensuing Office Action set forth specific rejections of the individual claims, so that the Applicant can better assess the rejections.

For at least the foregoing reasons, independent claim 9 (and dependent claims 10-13) patently defines over the cited art, and the rejections should be withdrawn.

As a separate and independent basis for the patentability of claims 1-13, Applicant respectfully traverses the rejection as failing to identify a proper basis for combining the Mui and Ki references. In combining these references, the Office Action stated only that the combination would have been obvious "because it is well known to test a chemical process in as close as possible to the actual conditions." (Office Action, page 5 lines 11-12). This alleged motivation is clearly improper in view of well-established Federal Circuit precedent.

It is well-settled law that in order to properly support an obviousness rejection under 35 U.S.C. § 103, there must have been some teaching in the prior art to suggest to one skilled in the art that the claimed invention would have been obvious. W. L. Gore & Associates, Inc. v. Garlock Thomas, Inc., 721 F.2d 1540, 1551 (Fed. Cir. 1983). More significantly,

> "The consistent criteria for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this [invention] should be carried out and would have a reasonable likelihood of success, viewed in light of the prior art. ..." Both the suggestion and the expectation of success must be founded in the prior art, not in the applicant's disclosure... In determining whether such a suggestion can fairly be gleaned from the prior art, the full field of the invention must be considered; for the person of ordinary skill in the art is charged with knowledge of the entire body of technological literature, including that which might lead away from the claimed invention."

(*Emphasis added.*) In re Dow Chemical Company, 837 F.2d 469, 473 (Fed. Cir. 1988).

In this regard, Applicant notes that there must not only be a suggestion to combine the functional or operational aspects of the combined references, but that the Federal Circuit also requires the prior art to suggest both the combination of elements and the structure resulting from the combination. Stiftung v. Renishaw PLC, 945 Fed.2d 1173 (Fed. Cir. 1991). Therefore, in order to sustain an obviousness rejection based upon a combination of any two or more prior art references, the prior art must properly suggest the desirability of combining the particular elements to derive a method of floating pattern loading, as claimed by the Applicant.

When an obviousness determination is based on multiple prior art references, there must be a showing of some "teaching, suggestion, or reason" to combine the references. Gambro Lundia AB v. Baxter Healthcare Corp., 110 F.3d 1573, 1579, 42 USPQ2d 1378, 1383 (Fed. Cir. 1997) (also noting that the "absence of such a suggestion to combine is dispositive in an obviousness determination").

Evidence of a suggestion, teaching, or motivation to combine prior art references may flow, inter alia, from the references themselves, the knowledge of one of ordinary skill in the art, or from the nature of the problem to be solved. See In re Dembiczak, 175 F.3d 994, 1000, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999). Although a reference need not expressly teach that the disclosure contained therein should be combined with another, the showing of combinability, in

whatever form, must nevertheless be "clear and particular." Dembiczak, 175 F.3d at 999, 50 USPQ2d at 1617.

If there was no motivation or suggestion to combine selective teachings from multiple prior art references, one of ordinary skill in the art would not have viewed the present invention as obvious. See In re Dance, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998); Gambro Lundia AB, 110 F.3d at 1579, 42 USPQ2d at 1383 ("The absence of such a suggestion to combine is dispositive in an obviousness determination.").

Significantly, where there is no apparent disadvantage present in a particular prior art reference, then generally there can be no motivation to combine the teaching of another reference with the particular prior art reference. Winner Int'l Royalty Corp. v. Wang, No 98-1553 (Fed. Cir. January 27, 2000).

Again, in the present situation, the Office Action has stated that the combination would be obvious "because it is well know to test a chemical process in as close as possible to the actual conditions." Applicant fails to understand how this alleged motivation would lead one to combine Ki with Mui. Further, the claims state nothing about testing in actual conditions. Therefore, this rationale appears totally misplaced in connection with respect to the claims.

For at least the additional reason that the Office Action failed to identify proper motivations or suggestions for combining the various references to properly support the rejections under 35 U.S.C. § 103, those rejections should be withdrawn.

No fee is believed to be due in connection with this amendment and response. If, however, any fee is deemed to be payable, you are hereby authorized to charge any such fee to Deposit Account No. 20-0778.

Respectfully submitted,

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